

in the central processing unit of computer system **100**, a peripheral processor such as a USB host controller, or a combination thereof.

[0039] In an alternative illustrative embodiment, controllers **208**, **210**, and **212** may connect to host computer **214** through different interfaces. For example, touch screen controller **208** could connect as a conventional touch pad using a PS/2 interface, while display controller **210** and backlight controller **212** connect by USB or by a specialized display interface.

[0040] Because touch screen **106** of **FIG. 1** replaces a conventional touch pad, touch screen **106** usually serves as a conventional pointing device for the computer. For this reason, the touch screen must be able to interface to the computer as a conventional mouse. This is a further reason for interface **218** to be either a mouse interface such as PS/2, or a general interface such as USB that includes support for conventional mice. Interface **218** may also provide for an alternate or extended interface protocol that allows for additional information about finger activity to be communicated to computer **214**, and for computer **214** to control display **204** and backlight **206**. This additional finger activity information may include the absolute location of the finger on the sensor surface. When appropriate driver software is loaded onto computer **214**, the driver software can enable the alternate or extended interface protocol to support the user interface enhancements of the present invention. When other driver software, such as a conventional mouse or touch pad driver, is loaded instead, interface **218** can revert to mouse or touch pad compatibility using touch sensor **202** as a conventional touch pad, and controller **210** or **216** can operate the display autonomously, such as by furnishing a suitable default display image for display **204**.

[0041] When the touch screen is used as a conventional touch pad, finger motions on the touch sensor (e.g., in a cursor positioning region, which could identify a starting position) will typically cause corresponding motions of a cursor on the main display, and clicks of “mouse” buttons (or action control icons) **108** will typically cause special actions, such as selections on the main display. Tapping gestures may be interpreted as “mouse” clicks or other special actions, as disclosed in U.S. Pat. No. 5,543,591. Other gestures may also be recognized, such as scrolling motions as disclosed in U.S. Pat. No. 5,943,052. The default display image may include graphical icons to indicate special tapping or scrolling regions on the touch sensor surface or the default screen image may be a blank screen with only a manufacturer’s logo.

[0042] In one embodiment, the cursor positioning region is denoted by the absence of icons for actions, other than cursor positioning. However, there are many different ways of identifying the cursor positioning region on the touch screen, such examples include, but are not limited to, a box could enclose the cursor positioning region, a shaded region or icon could cover the entire cursor positioning region, or an icon could be centered in an otherwise blank area, thus labeling the blank area as a cursor positioning region.

[0043] **FIG. 3** illustrates an example default image for use when the touch screen is operating as a conventional touch pad. **FIG. 3** depicts the image on the touch screen display as seen by the user. Image **300** includes arrow icons **302** and **304** indicating scrolling regions, an icon **306** indicating a

corner tap region that simulates a right mouse button click, and an icon **308** which represents a logo for the computer vendor.

[0044] Alternatively, computer system **100** of **FIG. 1** can include a secondary pointing device, such as an isometric joystick located in keyboard **104** or an external mouse, which relieves touch screen **106** from the responsibility of functioning as primary pointing device in addition to its role as an enhanced user interface device.

[0045] A conventional touch pad with default screen image is just one of several general modes of usage that are envisioned for the touch screen of the present invention. Subsequent drawing figures illustrate several other usage modes that employ the touch screen as a fully interactive input/output device to enhance the user interface of the computer system. These general usage modes include “iconic,” “auxiliary,” and “pop-up” touch screen modes, each with a variety of possible applications. The same touch screen can operate in each of these various modes, or other modes, at different times. The different modes can also appear on the screen at the same time; for example, icons can appear in an auxiliary or pop-up image, or an auxiliary or pop-up image could be overlaid in a window on the iconic mode image instead of fully replacing that image.

[0046] **FIG. 4** illustrates an example of a first “iconic” usage mode of the touch screen. In the iconic mode, the screen displays an image that includes a number of small icons such as pictures or buttons. The touch sensor operates as a touch pad pointing device in iconic mode, in which finger motions and taps on the sensor are generally interpreted the same as when the touch screen operates as a conventional touch pad. The screen image in iconic mode may include elements in common with the default image of **FIG. 3**, as the two modes operate similarly. Iconic mode will generally display additional icons relating to software that is running on the computer and other aspects of the operation of the computer.

[0047] In the example image of **FIG. 4**, image **400** includes scroll arrow icons **402** and **404** and a touch region, such as illustrated by corner tap icon **406** in common with **FIG. 3**. Logo **308** has been omitted from image **400** in this example to reduce clutter. In an alternate embodiment, non-critical graphics from the default image could be retained as a background image on which icons overlap; in yet another embodiment, a different image such as static or dynamic “wallpaper” may serve as a background image.

[0048] In example image **400**, additional icons have been added to represent various system status indicators and functions. Icon **410** defines a second touch region or a corner tapping region to activate the “back” function of web browsers and other software. As the user enables and disables special tap regions and changes their assigned functions, such as by using a software control panel, the tap region icons such as icons **406** and **410** can appear, disappear, move, and change in shape to reflect the current settings.

[0049] Icon **412** is a continuous display of the time and date. This icon would normally have no effect on the interpretation of finger taps within its region. Instead, a finger tap within its boundaries would be interpreted as a simulated mouse button click, just as if the tap occurred